

REMARKS

Claims 1-20 are pending in the application. Claims 1, 13, 16 and 19 have been amended. Claim 2 has been cancelled.

Claim Rejections – 35 U.S.C. §102(b)

The Examiner rejected claims 1-6, 11, 12 and 16-20 under 35 USC 102(b) as being anticipated by Maenaka (U.S. Patent No. 5,552,827). Applicant respectfully disagrees with the Examiner's rejection. In particular, Maenaka fails to teach or suggest "relatively weighing the pixel signal values, the relative weights depending, at least in part, on the relative change of pixel signal value level in a particular direction " and "computing a color signal includes relatively weighing the pixel signal values by relatively weighing more heavily the pixel signal values associated with the direction increasing less relatively in pixel signal value level for the particular pixel location" as claimed or similarly claimed.

As noted in the specification on page 6, first paragraph to page 8:

"As illustrated in Fig. 1, the immediately adjacent pixel locations in the horizontal and vertical directions comprise green pixel signal values. Therefore, these shall be employed to estimate the green pixel signal value for this particular pixel location. First, the relative change in the green pixel signal values for the horizontal direction and the vertical direction across this particular pixel location is computed and compared. This is accomplished using the following equations.

$$\begin{aligned} \text{Chor} &= G_{m,n+1} - G_{m,n-1} ; \\ \text{Cver} &= G_{m+1,n} - G_{m-1,n} ; \end{aligned}$$

If the relative change in the vertical direction is greater than the relative change in the horizontal direction, the relative change being relative to the magnitude of the values computed above, then the values in the horizontal direction, that is, in this embodiment, the green pixel signal values that are the immediately adjacent pixel signal values in the horizontal direction, are weighed more heavily. In this embodiment, the weight assigned to horizontal green pixel values have been chosen, based on experimentation, as 0.5, although the invention is not limited in scope in this respect. It is noted that other weights may be employed and provide satisfactory results. At the same time the weights assigned to vertical neighboring green pixel signal values have been chosen as 0.1, although the invention is not limited in scope in this respect. On the basis of the above discussion the missing green pixel signal values in this particular pixel location is estimated as

$$G_{m,n} = [0.5 * (G_{m,n-1} + G_{m,n+1}) + 0.1 * (G_{m-1,n} + G_{m+1,n})] / (0.5 + 0.5 + 0.1 + 0.1); \text{ or}$$

$$G_{m,n} = 0.41667 * (G_{m,n-1} + G_{m,n+1}) + 0.08333 * (G_{m-1,n} + G_{m+1,n});$$

However, if the relative change in the horizontal direction is greater than the relative change in the vertical direction, in terms of pixel signal level for the green pixel signal values, then a reverse approach is employed. More particularly, the vertical green pixel signal values that are immediately adjacent to the red pixel signal value, in this particular embodiment, are weighed more heavily. In particular, the green pixel signal value in this particular pixel signal location is estimated as follows.

$$G_{m,n} = 0.08333 * (G_{m,n-1} + G_{m,n+1}) + 0.41667 * (G_{m-1,n} + G_{m+1,n});$$

It is noted that the form of this equation is similar to the form above, except that the vertical and horizontal pixel signal values that are immediately adjacent to the red pixel signal value have been interchanged. Finally, if the two relative changes are equal, or substantially equal, then a simple average of the four green pixel signal values that are immediately adjacent to the red pixel signal value are averaged, for this embodiment, in accordance with the following equation.

$$G_{m,n} = 0.25 * (G_{m,n-1} + G_{m,n+1} + G_{m-1,n} + G_{m+1,n});$$

Therefore, in order to compute the signal value for the green color plane, where the particular pixel location has a pixel signal value in the red color plane, the pixel signal values immediately adjacent to that pixel location in the green color plane are compared. As shall be described in more detail below, it is not always the case that the color plane being computed corresponds to the particular color of the pixel signal values that are compared, although it is true in this embodiment for the situation just described." (Emphasis added.)

Maenaka fails to teach or suggest "relatively weighing the pixel signal values, the relative weights depending, at least in part, on the relative change of pixel signal value level in a particular direction." Rather, Maenaka teaches away from the present invention by simply employing an average of the pixels adjacent to a particular pixel location in which it was devised to interpolate the color signal value for those colors not included in the pixel location of a subsampled color image.

As noted in the present application on page 5, first paragraph:

As previously indicated, unfortunately, many color interpolation techniques typically do not produce high-quality color images because the

techniques employed typically do not take into account, or at least reasonably correctly take into account, how the human eye perceives color. *For example, a typical color interpolation technique may include averaging the pixels adjacent to a particular pixel location in which it was desired to interpolate the color signal value for those colors not included in that pixel location of a subsampled color image. (Emphasis added.)*

For example, Maenaka discusses calculating the average on column 7, lines 1-14:

In a case of the odd pixel shown in FIG. 8(A), the vertical interpolation circuit 64 outputs the color signal G22 as the color signal G_v of the pixel G22 as shown by the following equation (4). Pixels R12 and R32 sandwiching the pixel G22 are of the R signals, and therefore, *the color signal R_v is evaluated by performing the calculation of an average of the color signals R12 and R32 as shown by the following equation (5).* As to the color signal B_v, a calculation method is similar to that of the above described color signal R_h. More specifically, the G signal G21 of the pixel B21 is calculated as an averaged value of the signals G11 and G31, and the color signal B_v is calculated with a ratio between the color signal G21 and the color signal G22 (following equation (6)). (Emphasis added.)

Furthermore, Maenaka fails to teach or suggest comparing “computing a color signal includes relatively weighing the pixel signal values by relatively weighing more heavily the pixel signal values associated with the direction increasing less relatively in pixel signal value level for the particular pixel location.” As noted above, Maenaka requires an average to be calculated.

Claim Rejections – 35 U.S.C. §102(b)

The Examiner also rejected claims 1, 13, 16 and 19 under 35 U.S.C. 102(b) as being anticipated by Hamilton (U.S. Pat. No. 5,629,734). Applicant respectfully disagrees with the Examiner’s rejection. In particular, Hamilton fails to teach or suggest “computing a color signal includes relatively weighing the pixel signal values by relatively weighing more heavily the pixel signal values associated with the direction increasing less relatively in pixel signal value level for the particular pixel location” as claimed or similarly claimed. It is therefore respectfully requested that the Examiner withdraw his rejection of the pending claims.

Claim Rejections – 35 U.S.C. §103

Claims 7-10 are patentable over Maenaka in view of Hamilton for the same reasons noted above.

CONCLUSION

In view of the foregoing, it is respectfully asserted that all of the claims pending in this patent application are in condition for allowance.

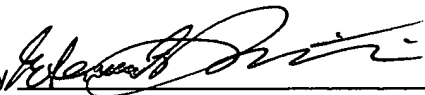
The required fee for a two month extension of time is enclosed. Should it be determined that an additional fee is due under 37 CFR §§1.16 or 1.17, or any excess fee has been received, please charge that fee or credit the amount of overcharge to deposit account #02-2666.

If the Examiner has any questions, he is invited to contact the undersigned at (323) 654-8218. Reconsideration of this patent application and early allowance of all the claims is respectfully requested.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR, & ZAFMAN LLP

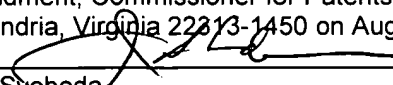
Dated: August 24, 2004

By 
Farzad E. Amini, Reg. No. 42,261

12400 Wilshire Boulevard
Seventh Floor
Los Angeles, California 90025
(310) 207-3800

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Jean Svehoda